CLAIMS

What is claimed is.

1. A thermal interface structure comprising:

at least one carbon nanotube oriented substantially parallel to a desired heat transfer axis of the thermal interface; and

an interstitial material in which the nanotubes are embedded.

2. The structure of claim 1, wherein the structure has a first surface to contact a surface of a circuit die and a second surface to contact a surface of a cooling solution, the first and second surfaces being substantially parallel to each other.

3. The structure of claim 2, wherein the thickness of the structure from the first surface to the second surface is about 5 to 20 microns.

4. The structure of claim 1 wherein the interstitial material is a polymeric material.

5. The structure of claim 4, wherein the polymeric material is selected from the group consisting of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde.

6. A thermal interface comprising:

at least one bundle of carbon nanotubes, the bundles oriented substantially parallel to each other and to a heat transfer flow path of the thermal interface; and

an interstitial material between the bundles of nanotubes.

7. The thermal interface of claim 6 wherein the interstitial material is a polymeric material.

8. The thermal interface of claim 6 wherein the thermal interface has first and second generally planar surfaces which are each substantially perpendicular to the heat transfer path.

9. A heat transfer structure for use with a semiconductor die comprising:

a heat sink having a surface to couple to the die; and

a thermally conductive element comprising a first surface coupled to the heat sink and a second surface coupled to the semiconductor die, the thermally conductive element comprising a plurality of carbon nanotubes oriented with their axes substantially perpendicular to the first and second surfaces.

10. The heat transfer structure of claim 9 wherein the thermally conductive element also comprises an interstitial bonding material interspersed among the carbon nanotubes.

11. The heat dissipating structure of claim 10 wherein the interstitial bonding material is a polymeric material selected from the group consisting of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde.

12. The heat dissipating structure of claim 9 wherein the thermally conductive element has a surface area that is substantially the same as the surface area of the die.

13. The heat dissipating structure of claim 12 wherein the thickness of the thermally conductive element is between **10** and **50** microns.

14. An electronic assembly comprising at least one integrated circuit package comprising:

at least one integrated circuit die;

a heat sink having a surface coupled to the die; and

a thermally conductive element comprising a first surface coupled to the heat sink and a second surface coupled to the die, the thermally conductive element comprising a plurality of carbon nanotubes oriented with their axes substantially perpendicular to the first and second surfaces.

15. The electronic assembly of claim 14 wherein the thermally conductive element also comprises an interstitial material embedded among the carbon nanotubes.

16. The electronic assembly of claim 15 wherein the interstitial material is a polymeric material selected from the group consisting of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde.

17. A data processing system comprising:

a bus coupling components to the data processing system;

a display coupled to the bus;

external memory coupled to the bus; and

a processor coupled to the bus and comprising an electronic assembly including at least one electronic package comprising:

at least one integrated circuit die;

a heat sink having a surface coupled to the die; and

a thermally conductive element comprising a first surface coupled to the heat sink and a second surface to couple to the die, the thermally conductive element comprising a plurality of carbon nanotubes oriented with their axes substantially perpendicular to the first and second surfaces.

18. The data processing system of claim 17 wherein the thermally conductive element comprises an interstitial material interspersed among the carbon nanotubes.

19. The data processing system of claim 18 wherein the interstitial material is a polymeric material selected from the group consisting of polycarbonate, polypropylene, polyacetal, polyoxymethylene and polyformaldehyde.

20. A method of fabricating a thermal interface structure comprising:

embedding an array of substantially aligned carbon nanotubes in an interstitial material to form an intermediate having a layer of substantially aligned carbon nanotubes embedded therein; and

removing excess material from the intermediate to provide a thermal interface structure having a first substantially planar surface for engaging a surface of one object and a second substantially planar surface for engaging a surface of another object, the first and second surfaces oriented substantially perpendicular to the substantially aligned carbon nanotubes.

21. The method of claim 20 wherein the array of substantially aligned carbon nanotubes also comprises a substrate from which the carbon nanotubes project and wherein the removing of excess material also comprises removing at least a portion of the substrate.

22. The method of claim 20 wherein removing excess material comprises chemical mechanical polishing of the intermediate.

23. The method of claim 20 wherein removing excess material comprises etching the intermediate.

24. A method of providing a thermal intermediate between two objects comprising:

providing an array of substantially aligned carbon nanotubes coupled to one of the objects;

embedding the array of substantially aligned carbon nanotubes in an interstitial material to form a layer of substantially aligned carbon nanotubes embedded therein; and

coupling the array to the other object.

25. The method of claim 24 wherein providing the array coupled to the object comprises forming the carbon nanotubes on the surface of the object

26. The method of claim 24 wherein providing the array coupled to the object comprises

forming the array on a substrate;

embedding the array in an interstitial material;

removing the substrate; and

coupling the array to the object.